PATENT ABSTRACTS OF JAPAN

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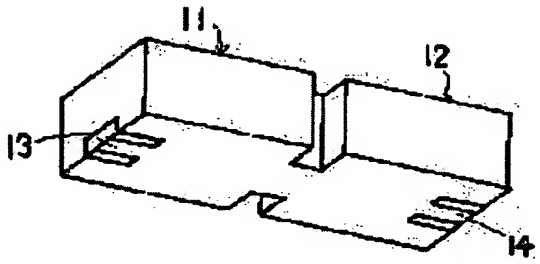
(54) WAVEGUIDE-TYPE DIELECTRIC FILTER

(57)Abstract:
PROBLEM TO BE SOLVED: To eliminate discontinuity between the signal lines of a wiring board and the input/output electrodes of a waveguide-type dielectric filter so as to reduce the dielectric filter in reflection or radiation loss.
SOLUTION: Conductor patterns 13 and 14 extending inwards from the edges of a base are used as input/output electrodes and connected to microstrip lines or coplanar lines. The conductor films 13 and 14 are extended to the edge of the edge face of a dielectric body, and the dielectric body is exposed at the edge face where the conductor films 13 and 14 are brought into contact. The tongue-shaped conductor films 13 and 14 serve as input/output electrodes and are connected to the microstrip lines or coplanar lines which are of the same width with the conductor films and formed on a wiring board. The dielectric body is partly exposed around the conductor films 13 and 14, and the other surface of the dielectric body containing the connected parts is all covered with a conductor film.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] In the waveguide mold dielectric filter which the dielectric resonator of two or more rectangular parallelepipeds was connected, and equipped the resonator of both ends with the I/O electrode The same base of the resonator of both ends is arrived at around there from the location distant from the one side. the conductor which a dielectric exposes to both sides -- the whole surface of the dielectric had the input/output terminal electrode by the membranous tongue-shaped piece, and the dielectric has exposed the part which touches at the tip of the tongue-shaped piece of the side face which touches around there, and excluding the circumference of an I/O electrode, and a joining segment -- a conductor -- the waveguide mold dielectric filter characterized by what the film was formed for.
[Claim 2] The waveguide mold dielectric filter according to claim 1 by which an I/O electrode is connected with the microstrip line of a wiring substrate.
[Claim 3] The waveguide mold dielectric filter according to claim 1 by which an I/O electrode is connected with the KOPURENA track of a wiring substrate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a waveguide mold dielectric filter, and relates to the structure of the I/O electrode especially. It is related with the input-output structure which can be used for the resonator which constitutes the filter, the duplexer using the filter, etc.
[0002]
[Description of the Prior Art] as the filter used in a frequency band several GHz or more -- the dielectric of a rectangular parallelepiped -- a conductor -- use of the dielectric filter of the waveguide mold which is made to combine two or more resonators covered by the film, and acquires a desired property inquires -- having -- **** -- the phase of utilization -- welcoming -- like is supposed. Since it has structure which filled up the conventional guided wave ****** with the dielectric, the miniaturization of size is attained.
[0003] However, in this kind of waveguide mold dielectric filter, the joint structure of an input/output terminal poses a big problem. Until now, as shown in drawing 11, what formed the through tube in the dielectric, the thing which formed the conductor pattern of I/O in the side face of a dielectric as shown at drawing 12 are proposed.
[0004] However, in a connection part, discontinuity with the track on the circuit board becomes large, the loss of I/O joint structure [such] by the reflection and radiation by discontinuity increases very much, and it has especially the problem of not being suitable for utilization in a high frequency band 10GHz or more. Although adopting the shielding structure for making radiation and reflection small is also considered, the problem of the increment in the man day accompanying the increment in components mark and cost arises.
[0005]
[Problem(s) to be Solved by the Invention] This invention makes small discontinuity of the input/output terminal electrode of a filter when mounting a waveguide mold dielectric filter in the circuit board, and the signal line on a substrate as much as possible, and offers a means to reduce the loss caused by reflection and radiation of the electromagnetic field in the I/O section. And it realizes with easy electrode structure.
[0006]
[Means for Solving the Problem] This invention solves the above-mentioned technical problem by forming the conductor pattern of the same configuration as the I/O electrode of a waveguide mold dielectric filter the I/O electrode side of the waveguide mold dielectric filter of the signal line on the circuit board.
[0007] Namely, the dielectric resonator of two or more rectangular parallelepipeds is connected, and it sets in the waveguide mold dielectric filter which equipped the resonator of both ends with the I/O electrode. The same base of the resonator of both ends is arrived at around there from the location distant from the one side. the conductor which a dielectric exposes to both sides -- the whole surface of the dielectric had the input/output terminal electrode by the membranous tongue-shaped piece, and the dielectric has exposed the part which touches at the tip of the tongue-shaped piece of the side face which touches around there, and excluding the circumference of an I/O electrode, and a joining segment -- a conductor -- it has the description for the film to have been formed.
[0008]

[Embodiment of the Invention] The electrode pattern of the shape of the same shape of a microstrip line as the signal and line which were formed in the base of the I/O stage of a waveguide mold dielectric filter at the circuit board (print) which mounts that waveguide mold dielectric filter, and a coplane track is formed, and termination of this conductor pattern is carried out on the base concerned. While connecting with the signal line of the circuit board, the signal supplied from the circuit board is combined with the resonance mode inside a waveguide mold dielectric filter by this.
[0009]
[Example] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 is the perspective view showing the example of this invention. Specific inductive capacity connects the dielectrics 11 and 12 of two 5.2mmx5.2mmx2.5mm rectangular parallelepipeds by 2.3mm width of face at the dielectric of 9.0 with the same dielectric whose die length is 1.0mm. the conductor whose die length is 1.4mm by the side of an end face to 1.0mm width of face on the same base -- film 13 and 14 was formed and the dielectric is exposed to those both sides by 0.5mm width of face.
[0010] a conductor -- the conductor of the end face which film 13 and 14 is extended to the side of the end face of a dielectric, and touched around there -- the dielectric is exposed also for the part which touches film 13 and 14. these tongue-shaped conductors -- film 13 and 14 serves as an I/O electrode, and is connected with the microstrip line of the same width of face or coplane track formed in the wiring substrate. a conductor -- although the dielectric is exposed in a part of perimeter of film 13 and 14 -- other front faces -- a connection part -- containing -- the whole surface -- a conductor -- it has covered by the film.
[0011] The property of the waveguide mold dielectric filter shown in drawing 1 is shown in drawing 2 . The waveguide mold dielectric filter with few 450MHz and the insertion losses to 0.6dB and loss was obtained [center frequency] for 12.97GHz and 3dB bandwidth.
[0012] Although it is necessary to enlarge association with a resonator and an external circuit in order to make bandwidth of a filter large, association with an external circuit can be adjusted by changing the dimension of an I/O electrode pattern. If the gap around an I/O electrode pattern (outcrop of a dielectric) is enlarged, an outer join can be enlarged and bandwidth can be extended.
[0013] Drawing 3 is the perspective view showing other examples of this invention. Although it is the almost same structure as the above, the dielectrics 31 and 32 of two 5.2mmx4.8mmx2.5mm rectangular parallelepipeds are connected by 2.3mm width of face with the same dielectric whose die length is 1.0mm. the conductor whose die length is 1.4mm by the side of an end face to 1.0mm width of face on the same base -- film 33 and 34 was formed and the dielectric is exposed to those both sides by 1.0mm width of face. the above -- the same -- a conductor -- although the dielectric is exposed in a part of perimeter of film 33 and 34 -- other front faces -- a connection part -- containing -- the whole surface -- a conductor -- it has covered by the film.
[0014] The property of the waveguide mold dielectric filter shown in drawing 3 is shown in drawing 4 . The waveguide mold dielectric filter with few 980MHz and the insertion losses to 0.5dB and loss was obtained [center frequency] for 13.12GHz and 3dB bandwidth. Thus, bandwidth is more than twice by having extended the gap of an I/O electrode.
[0015] A waveguide mold dielectric filter may connect three or more resonators, in order to acquire a desired band-pass response. Drawing 5 is the perspective view showing other examples of this invention. 55 dielectricity of the dielectrics 51 and 52 of two 5.2mmx5.2mmx2.5mm rectangular parallelepipeds and the 5.2mmx5.0mmx2.5mm rectangular parallelepiped arranged in the meantime is connected by 2.3mm width of face with the same dielectric whose die length is 1.0mm. the conductor whose die length is 1.4mm by the side of an end face to 1.0mm width of face on the same base -- film 53 and 54 was formed and the dielectric is exposed to those both sides by 0.5mm width of face.
[0016] The property of the waveguide mold dielectric filter shown in drawing 5 is shown in drawing 6 . The waveguide mold dielectric filter with little loss was similarly obtained for center frequency like [13.01GHz and 3dB bandwidth / 400MHz and an insertion loss] 0.9dB and an above-mentioned example. Since the number of stages was increased, the damping property outside a passband is steep.
[0017] An I/O electrode can choose the location and sense as arbitration, as shown in drawing 7 (a) -

(f). However, to form in the same front face (base) is required. Moreover, the part of an I/O electrode can also be made to project, as shown in drawing 8 .

[0018] The mounting structure of the waveguide mold dielectric filter by this invention is explained. Drawing 9 embeds the waveguide mold dielectric filter 90 at a printed circuit board 96, and it is in the condition before mounting and (b) is in the condition after mounting, and (a) solders, as shown in (b) and the I/O electrodes 93 and 94 and the KOPURENA track 97 serve as the same flat surface. In this case, there is an advantage to which the continuity of a track is kept high.

[0019] Other mounting structures of the waveguide mold dielectric filter by this invention are explained. Drawing 10 carries the waveguide mold dielectric filter 100 on a printed circuit board 106, it is in the condition before mounting, (b) is in the condition after mounting, and (a) solders an I/O electrode and the KOPURENA track 107. In this case, although the discontinuity of a track arises, an assembly has the advantage which becomes easy. A signal-line way may use a microstrip line.

[0020]

[Effect of the Invention] Since the I/O electrode of a configuration with which the signal-line way on the circuit board was extended is entering and carrying out termination to the dielectric resonator according to this invention, the I/O signal of the TEM mode flows on a base. According to this current, the field by which induction is carried out to the interior of the resonator of a waveguide mold combines with the field of the basic resonance mode of the resonator of a waveguide mold, and association with an external circuit and a resonator arises as that result.

[0021] Consequently, a signal-line way and an I/O electrode are shown in the same front face, and since it is the same width of face, the reflection and radiation of a RF signal which the continuity of the signal line of the circuit board and the input/output terminal electrode of a filter is maintained, and are produced in discontinuity can be controlled, and it becomes possible to decrease loss.

[Translation done.]

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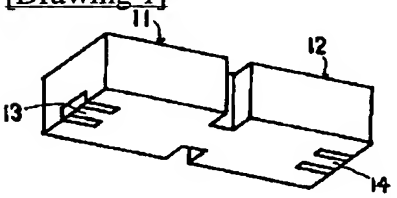
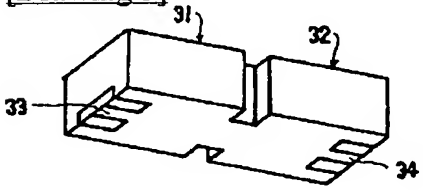
DRAWINGS

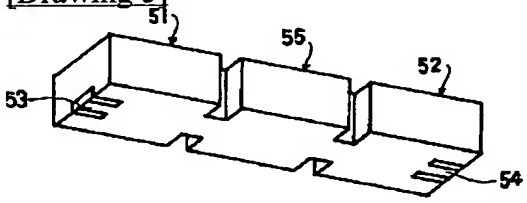
[Drawing 1]



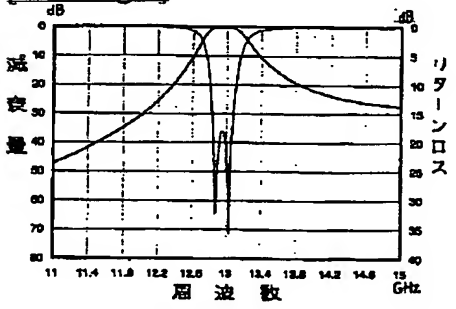
[Drawing 3]



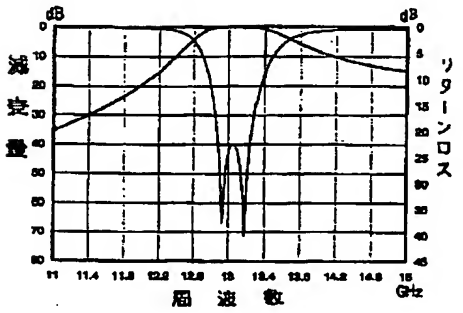
[Drawing 5]



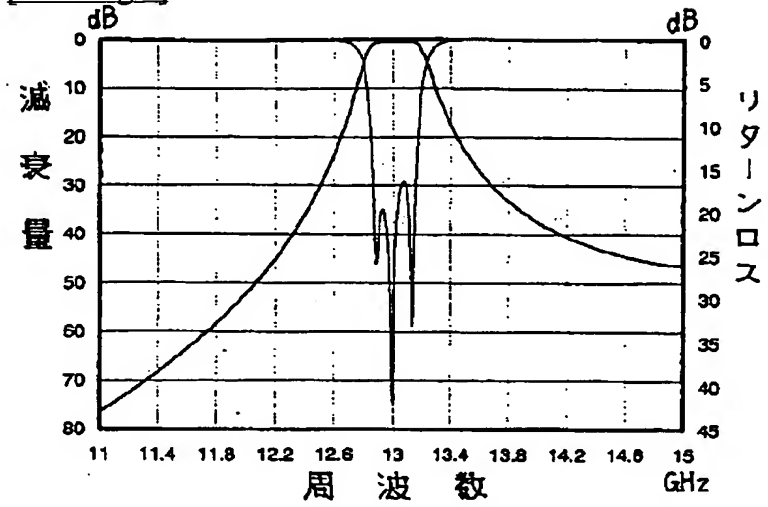
[Drawing 2]



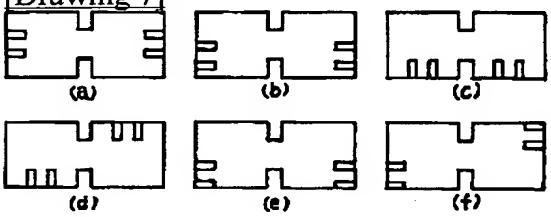
[Drawing 4]



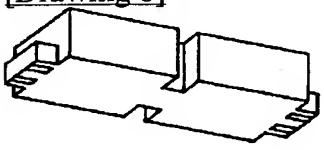
[Drawing 6]



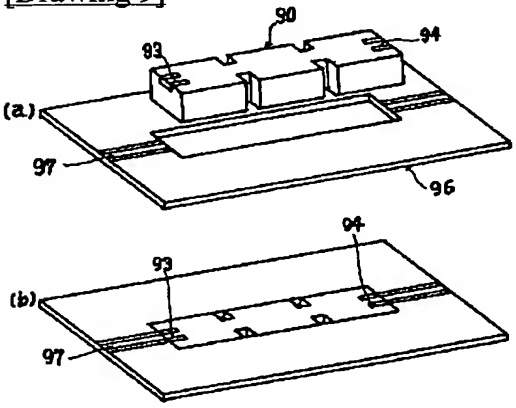
[Drawing 7]



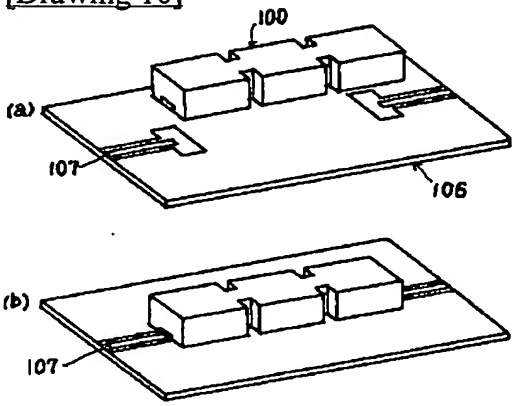
[Drawing 8]



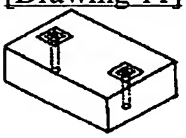
[Drawing 9]



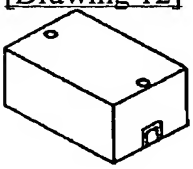
[Drawing 10]



[Drawing 11]



[Drawing 12]



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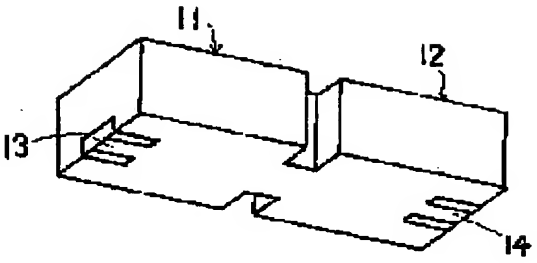

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5/107		5/107	Ｅ	

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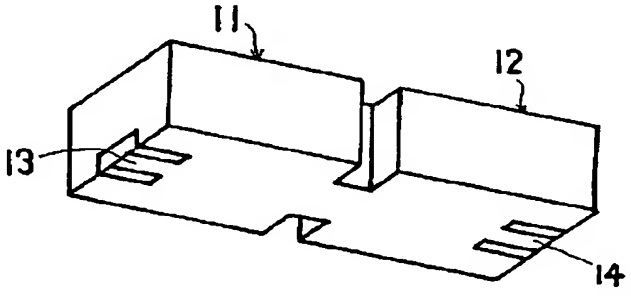
最終頁に続く

(54)【発明の名称】　導波管型誘電体フィルタ

(57)【要約】　（修正有）
【課題】　配線基板の信号線路と入出電極との不連続をなくして、反射や放射による損失を小さくする。
【解決手段】　入出力電極として底面の端部から内部に伸びる導体パターン１３，１４を用い、この導体パターンをマイクロストリップ線路あるいはコプレーナ線路に接続する。導体膜１３，１４は誘電体の端面の辺まで伸びており、その辺に接した端面の導体膜１３，１４に接する部分も誘電体が露出されている。これらの舌片状の導体膜１３，１４が入出力電極となり、配線基板に形成された同じ幅のマイクロストリップ線路あるいは共面線路と接続される。導体膜１３，１４の周囲の一部で誘電体が露出しているが、他の表面は接続部分を含んで全面を導体膜で覆ってある。



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【特許請求の範囲】

【請求項１】　複数の直方体の誘電体共振器が連結され、両端の共振器に入出力電極を具えた導波管型誘電体フィルタにおいて、両端の共振器の同一底面に、１つの辺から離れた位置からその辺に達し、両側に誘電体が露出する導体膜の舌片による入出力端子電極を具え、その辺に接する側面の舌片の先端に接する部分は誘電体が露出しており、入出力電極の周辺と連結部分を除いた誘電体の全面に導体膜が形成された、ことを特徴とする導波管型誘電体フィルタ。

【請求項２】　入出力電極が配線基板のマイクロストリップ線路と接続される請求項１記載の導波管型誘電体フィルタ。

【請求項３】　入出力電極が配線基板のコプレーナ線路と接続される請求項１記載の導波管型誘電体フィルタ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、導波管型誘電体フィルタに係るもので、特に、その入出力電極の構造に関するものである。そのフィルタを構成する共振器、また、そのフィルタを利用したデュプレクサ等にも利用できる入出力構造に関するものである。

【０００２】

【従来の技術】数GHz以上の周波数帯域で用いるフィルタとして、直方体の誘電体を導体膜で覆った共振器を複数個結合させて所望の特性を得る導波管型の誘電体フィルタの利用が検討されており、実用化の段階を迎えようとしている。従来の導波管内をを誘電体で充填した構造となっているので、サイズの小型化が可能となる。

【０００３】ただ、この種の導波管型誘電体フィルタにおいては、入出力端子の結合構造が大きな問題となっている。これまでに、図11に示したように、誘電体に貫通孔を形成したものや、図12に示したように、誘電体の側面に入出力の導体パターンを形成したものなどが提案されている。

【０００４】しかし、このような入出力結合構造は、接続部分において、回路基板上の線路との不連続性が大きくなって、特に10GHz以上の高周波帯域では不連続部での反射や放射による損失が非常に多くなってしまい、実用化に適さないという問題がある。放射や反射を小さくするためのシールド構造を採用することも考えられるが、部品点数の増加に伴う工数、コストの増加の問題が生じる。

【０００５】

【発明が解決しようとする課題】本発明は、導波管型誘電体フィルタを回路基板に実装した時の、フィルタの入出力端子電極と基板上の信号線との不連続を極力小さくして、入出力部での電磁界の反射や放射によって引き起こされる損失を低減する手段を提供するものである。しかも、簡単な電極構造で実現するものである。

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【０００６】

【課題を解決するための手段】本発明は、回路基板上の信号線の導波管型誘電体フィルタの入出力電極側と導波管型誘電体フィルタの入出力電極とに、同じ形状の導体パターンを形成することによって、上記の課題を解決するものである。

【０００７】すなわち、複数の直方体の誘電体共振器が連結され、両端の共振器に入出力電極を具えた導波管型誘電体フィルタにおいて、両端の共振器の同一底面に、１つの辺から離れた位置からその辺に達し、両側に誘電体が露出する導体膜の舌片による入出力端子電極を具え、その辺に接する側面の舌片の先端に接する部分は誘電体が露出しており、入出力電極の周辺と連結部分を除いた誘電体の全面に導体膜が形成されたことに特徴を有するものである。

【０００８】

【発明の実施の形態】導波管型誘電体フィルタの入出力段の底面に、その導波管型誘電体フィルタを実装する（プリント）回路基板に設けられた信号と線と同様なマイクロストリップ線路状、あるいは共面線路状の電極パターンを形成し、この導体パターンを当該底面で終端させる。これによって、回路基板の信号線と接続されるとともに、回路基板から供給される信号が導波管型誘電体フィルタ内部の共振モードと結合される。

【０００９】

【実施例】以下、図面を参照して、本発明の実施例について説明する。図１は、本発明の実施例を示す斜視図である。比誘電率が9.0の誘電体で5.2mm×5.2mm×2.5mmの２つの直方体の誘電体11、12を2.3mm幅で長さが1.0mmの同じ誘電体で接続したものである。同じ底面に、端面の辺から1.0mm幅で長さが1.4mmの導体膜13、14が形成され、それらの両側には0.5mm幅で誘電体が露出している。

【００１０】導体膜13、14は誘電体の端面の辺まで伸びており、その辺に接した端面の導体膜13、14に接する部分も誘電体が露出されている。これらの舌片状の導体膜13、14が入出力電極となり、配線基板に形成された同じ幅のマイクロストリップ線路あるいは共面線路と接続される。導体膜13、14の周囲の一部で誘電体が露出しているが、他の表面は接続部分を含んで全面を導体膜で覆ってある。

【００１１】図１に示した導波管型誘電体フィルタの特性を図２に示す。中心周波数が12.97GHz、3dB帯域幅が450MHz、挿入損失が0.6dBと、損失の少ない導波管型誘電体フィルタが得られた。

【００１２】フィルタの帯域幅を広くするためには、共振器と外部回路との結合を大きくする必要があるが、外部回路との結合は入出力電極パターンの寸法を変えることによって調整できる。入出力電極パターンの周囲のギャップ（誘電体の露出部）を大きくすると、外部結合を

大きくして、帯域幅を広げることができる。

【００１３】図３は、本発明の他の実施例を示す斜視図である。前記とほぼ同じ構造であるが、5.2mm×4.8mm×2.5mmの２つの直方体の誘電体31、32を2.3mm幅で長さが1.0mmの同じ誘電体で接続したものである。同じ底面に、端面の辺から1.0mm幅で長さが1.4mmの導体膜33、34が形成され、それらの両側には1.0mm幅で誘電体が露出している。前記と同様に、導体膜33、34の周囲の一部で誘電体が露出しているが、他の表面は接続部分を含んで全面を導体膜で覆ってある。

【００１４】図３に示した導波管型誘電体フィルタの特性を図４に示す。中心周波数が13.12GHz、3dB帯域幅が980MHz、挿入損失が0.5dBと、損失の少ない導波管型誘電体フィルタが得られた。このように、入出力電極のギャップを広げたことで、帯域幅が2倍以上となっている。

【００１５】導波管型誘電体フィルタは所望の帯域通過特性を得るために、3個以上の共振器を接続してもよい。図５は、本発明の他の実施例を示す斜視図である。5.2mm×5.2mm×2.5mmの２つの直方体の誘電体51、52とその間に配置された5.2mm×5.0mm×2.5mmの直方体の誘電55体を2.3mm幅で長さが1.0mmの同じ誘電体で接続したものである。同じ底面に、端面の辺から1.0mm幅で長さが1.4mmの導体膜53、54が形成され、それらの両側には0.5mm幅で誘電体が露出している。

【００１６】図５に示した導波管型誘電体フィルタの特性を図６に示す。中心周波数が13.01GHz、3dB帯域幅が400MHz、挿入損失が0.9dBと、上述の実施例と同様に同様に損失の少ない導波管型誘電体フィルタが得られた。段数を増やしたので通過帯域外の減衰特性が急峻となっている。

【００１７】入出力電極は、図７（ａ）～（ｆ）に示したように、その位置や向きを任意に選ぶことができる。ただし、同じ表面（底面）に形成することが必要である。また、図８に示したように、入出力電極の部分を突出させることもできる。

【００１８】本発明による導波管型誘電体フィルタの実装構造について説明する。図9はプリント基板96に導波管型誘電体フィルタ90を埋め込むもので、(a)は実装前の状態、(b)は実装後の状態で、(b)のように入出力電極93、94とコプレーナ線路97とが同じ平面となるようにして半田付けしたものである。この場合は、線路の連続性が高く保たれる利点がある。

【００１９】本発明による導波管型誘電体フィルタの他の実装構造について説明する。図10はプリント基板106上に導波管型誘電体フィルタ100を搭載するもので、(a)は実装前の状態、(b)は実装後の状態で、入出力電極とコプレーナ線路107とを半田付けしたものである。この場合は、線路の不連続性が生じるが、組み立ては容易となる利点がある。信号線路はマイクロストリップ線路を用いてもよい。

【００２０】

【発明の効果】本発明によれば、回路基板上の信号線路が延長された形状の入出力電極が、誘電体共振器に入り込んで終端しているので、底面にＴＥＭモードの入出力信号が流れる。この電流によって、導波管型の共振器の内部に誘起される磁界が導波管型の共振器の基本共振モードの磁界と結合して、その結果として外部回路と共振器との結合が生じる。

【００２１】その結果、信号線路と入出力電極とが同じ表面にあり、また同じ幅であるために、回路基板の信号線とフィルタの入出力端子電極との連続性がたもたれ、不連続部に生じる高周波信号の反射や放射を抑制することができ、損失を減少させることが可能となる。

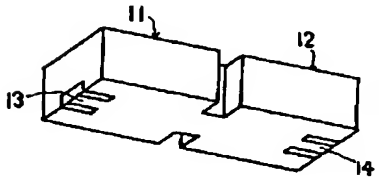
【図面の簡単な説明】

【図１】　本発明の実施例を示す斜視図
【図２】　図１のフィルタの特性の説明図
【図３】　本発明の他の実施例を示す斜視図
【図４】　図３のフィルタの特性の説明図
【図５】　本発明の他の実施例を示す斜視図
【図６】　図５のフィルタの特性の説明図
【図７】　入出力電極の例を示す底面図
【図８】　本発明の他の実施例を示す斜視図
【図９】　本発明の他の実施例を示す斜視図
【図１０】　本発明の他の実施例を示す斜視図
【図１１】　従来の誘電体フィルタの斜視図
【図１２】　従来の誘電体フィルタの斜視図

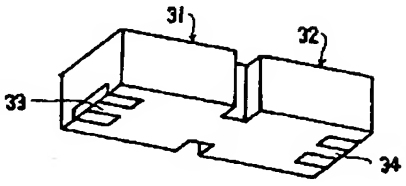
【符号の説明】

11、12、31、32、51、52、55：誘電体共振器
13、14、33、34、53、54、93、94：入出力電極
97、107：コプレーナ線路

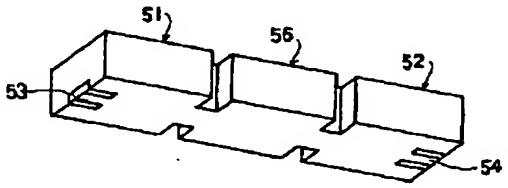
【図１】



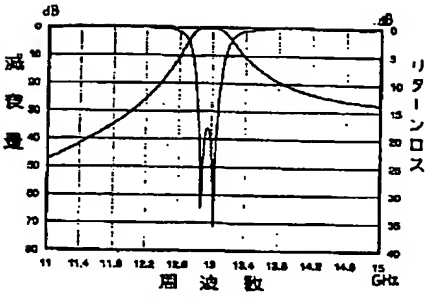
【図３】



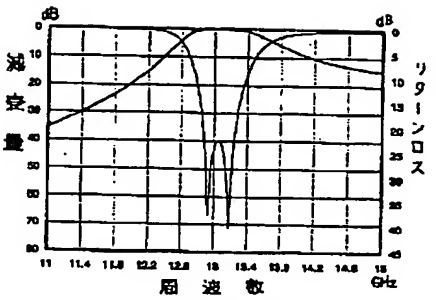
【図５】



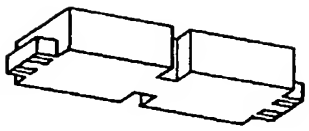
【図２】



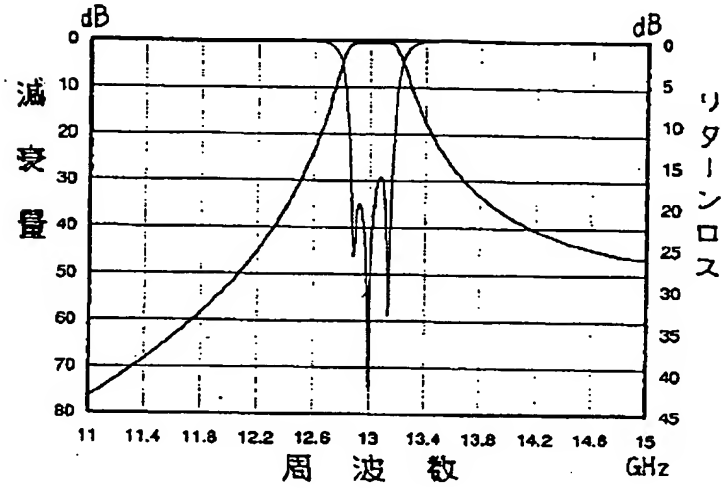
【図４】



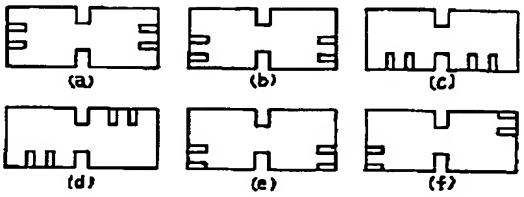
【図８】



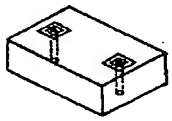
【図６】



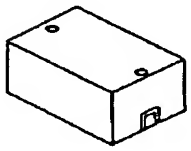
【図７】



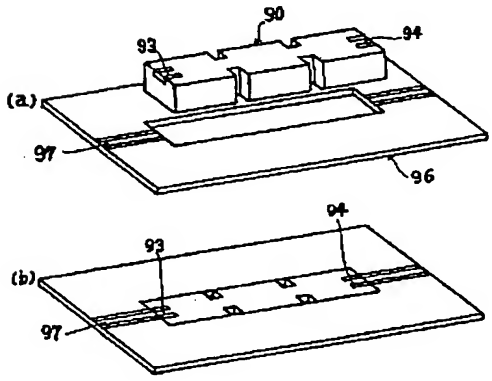
【図１１】



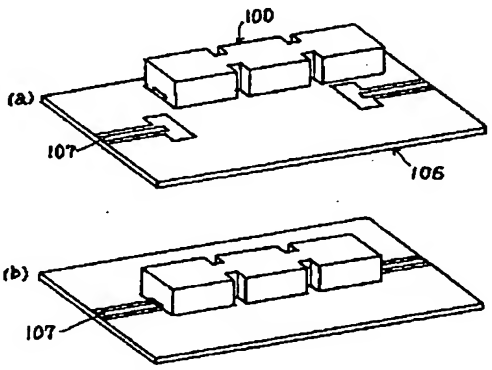
【図１２】



【図９】



【図１０】



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